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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

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(54) Synthetic Turf with Wide Grass-Like Pile Interspacing

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(71) Same as inventor

(57) 9 Claims

Notice: This application is as filed and may therefore contain an incomplete specification.

Canada

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Synthetic turf with wide grass-like pile interspacing

ABSTRACT OF THE DISCLOSURE

A playing surface for field sports games comprising: a firm, stable subsurface; a pile fabric, having a flexible backing supported by the firm subsurface and normally upstanding grass-like piles, the length of the piles being substantially uniform and lying in the range from 0,375 to 3 inches, wherein the piles further define an interspacing gap between any two successive piles, σ, whereby: 0,75 inch $\leq \sigma <$ 1.25 inch; and a top-dressing layer, comprising ordinary sand (or other particulate material as disclosed in canadian patent 1,182,484), interspersed among the piles, to a substantially uniform depth at least half the length of the piles.

FIELD OF THE INVENTION

This invention relates to synthetic turf playing surfaces for various sports, and particularly those sports where spike (or cleat) bearing shoes are worn.

CROSS-REFERENCE DATA

The subject matter of Canadian patent No 1,182,484 issued 12 February 1985 to *Mod-Sod Sports Surfaces*, is hereby incorporated by way of reference to the present patent application.

BACKGROUND OF THE INVENTION

Synthetic turf fields have been in existence for approximately twenty years: see for instance United States patent No 3,332,838. Sand-filled (topdressed) synthetic turf fields have been in existence for about fifteen years. On these sand-filled synthetic turf fields, the use of elastomeric underpads have been extensively used to add resiliency for the impact of the player running or falling on the top surface thereof. However, most of these synthetic grasses become very hard and compacted at their top surface, thereby causing these top surfaces to become very hard for the athletic shoe spikes or cleats to properly penetrate in order to maintain the necessary footing for the various sports.

Heavy use and the nature of the synthetic grass-like turfs cause turf compaction, whereby uncompacting of the surfaces, or at least keeping these surfaces at a level of compaction that is acceptable to the various sports, has been virtually impossible.

Therefore, no prior art athletic synthetic turf currently exists, in the present inventor's knowledge, which is of very low manufacturing cost, which can be maintained at a reasonably high

level of resiliency and compaction, whereby the synthetic turf can be longer lasting so as to thereby provide more predictable spike or cleat shoe footing over the life of the surface.

There is also an unmet need for low cost sand filled and\or sand and resilient materials for synthetic grass surfacing, that could be economically installed for municipal and professional applications.

In Canadian patent No 1,182,484, *supra*, there is disclosed a synthetic turf playing surface comprising at least a firm subsurface, a plurality of grass-like pile fabric elements, upstanding over the firm subsurface, and particulate material, laying over the subsurface and interspersed among the grass-like pile elements. The length of the pile element is limited to a range between 0,5 to 2 inches; while the thickness of the particulate material is limited to a depth of at least half the length of the pile elements. Such a synthetic turf construction is claimed to address the needs of players engaging *contact sports* such as soccer, football, and the like, on the playing fields. The playing fields for such sports must generally meet a number of goals, from the players' perspective:

(a) the soil must remain substantially stable throughout the duration of the game. This is important in view of limiting the problems associated with mud or dust, namely: time-dependent (variable) load-bearing properties, ambient air clearness, mud-gathering on the player's skin, and the like. With such outcomes, the performance of the players will inevitably decrease as the game

advances, and more to the point, the likelihood of accidental physical injuries to the players, typically slipping and falling repeatedly over ground during the game, will undesirably increase;

(b) yet, the stability-enhancing features of the playing field should not introduce surface abrasiveness, since as a player falls on such surfaces, upon running or making sharp turns thereon or sustaining bodily impact from an opponent's party player, he may involuntarily inflict upon himself severe rug-burns i.e. may scrape his skin (there is rapid motion over ground of these players);

(c) preferably, the resiliency of the playing surface should not be too pronounced, to prevent generating a feeling for the players of running or walking across a springy or spongy surface.

Other considerations, less critical to the players but more important to the playing field managers and maintenance crews thereof, that should also be met, are as follows:

(d) the durability of the playing surface should be high, since maintenance costs of such playing fields are labour-intensive and therefore expensive;

(e) the appearance of the artificial turf should remain attractive throughout the game, so that the psychological interest of the *paying* assistance fans should not be compromised for aesthetic reasons; and

(f) the manufacturing cost and maintenance cost of this artificial playing surface should be as low as possible.

In the specification of this Canadian patent No 1,182,484, the upstanding grass-like pile elements are defined as

each consisting of [redacted] multi-filament yarn, made on [redacted] machine 3\8 gauge from polypropylene ribbon 5 mils thick, being slit and twisted to form a plurality of thin filaments. Each strand of pile yarn is said to comprise between 20 to 50 or more individual filaments. The density of the tufts is said to be *variable*, depending upon the weight of the pile yarn and the intended use of the playing surface. It is stated, in a generally *incidental* fashion (and not claimed in the claims), that a stitch rate from about 3 to 8 stitches per inch of grass-like pile elements having 3\8 gauge, 5 mil thick polypropylene ribbon yarns over a playing field, would be *useful*. Such a stitch rate ranging between 3 to 8 stitches per inch, means in other words an average spacing between two successive grass-like pile elements, ranging between 0,125 of an inch to 0,333 of an inch.

It is clear from the analysis of the specification and claims of Canadian patent No 1,182,484 that, contrarily to the *density* of the grass-like pile elements, which is commented only in an *incidental* fashion, the specific *length* of the grass-like pile elements, as well as the specific *depth and composition* of the top-dressing particulate material interspersed among the pile elements over the firm supporting subsurface, are the subject of careful and detailed developments, indicative of their criticality in the mind of the inventor in this latter patent.

OBJECTS OF THE INVENTION

The gist of the present invention is therefore to provide a synthetic turf playing surface that addresses the needs of

players wearing spike (or cleat)-bearing shoes, particularly for sports such as soccer, football and golf.

An object of the invention is that this synthetic turf would be capable of being maintained for very long periods of time at an at least minimal level of resiliency over the whole life of the synthetic turf.

An object of the invention is that such large fields of synthetic turf would require only minimal time for full operative installation, at very low costs, typically at costs of up to 30 to 50 % less than the cost for prior art sand-filled synthetic turf fields.

An important object of the invention is to provide such a synthetic turf as above-disclosed, wherein the top-dressing would be sand-filled with resilient material (such as the particulate material disclosed in the above-captioned Canadian patent No 1,182,484) so as to be appropriate for use in driving golf balls off driving ranges as well as for use over tee off areas, thereby simulating real grass without altering the normal down stroke of golfers that hit on natural grass.

An object of this invention is that such large synthetic turf playing surfaces could be installed without secondary backings, except for golf playing fields (where there is needed a secondary backing to hold the tufts in for tee off grass).

A further object of the invention is that where tuft bind is important for such large field applications of synthetic turfs, a tack coat can be applied to the crushed aggregate surface to bind

the tufts to it, whereby the need for a secondary backing through an oven is eliminated.

An object of the invention is that such large synthetic turf fields have a low cost but, because the carpet rolls be sewn rather than glued, whereby the synthetic turf seams become more resistant.

An object of the invention is that the granulometry of the top-dressing of such large synthetic turf playing surfaces can be larger than other similar, narrow pile interspacing synthetic turfs, while still providing a very low abrasion surface.

The general object of the invention is that such large synthetic turf fields with sand-filled resilient particulate material-filled topdressing, be of a low density of pile elements, to allow the sports shoe spikes or cleats to easily penetrate the surface without sustaining appreciable torsional loads which would be applied by a sudden bodily weight transfer or change in direction of the player.

An object of the invention is that such sand-filled synthetic turf fields use regular washed, undried sand, in view of still lowering the costs.

A corollary object of the invention is to facilitate picking of ground-standing golf balls.

A further object of the invention is to improve water drainage of the synthetic turf surface, because of the backing porosity.

An object of the invention is that low abrasion of the

synthetic turf golf playing surface is achieved for driving ranges, because of the ability of the widely interspersed pile elements to yieldingly bend over upon sustaining the impact of the ball picker motorized unit's rotary wheels.

SUMMARY OF THE INVENTION

Accordingly with the objects of the invention, there is disclosed a playing surface for field sports games where the players wear cleat-bearing shoes, said playing surface comprising: a firm, stable subsurface; a pile fabric, having a flexible backing and normally upstanding grass-like pile elements, the length of said pile elements being substantially uniform and lying in the range from 0,375 to 3 inches, wherein said pile elements further define an interspacing gap between any two successive said pile elements (preferably pile element rows), σ, whereby: 0,75 inch $\leq \sigma$ < 1.25 inch; and a top-dressing layer, comprising sand (preferably a mixture of from 24 to 95 volume percent resilient particles and from 5 to 75 volume percent fine sand) interspersed among the pile elements and on the backing to a substantially uniform depth at least half the length of said pile elements.

doesn't Satisfy relationship

Detailed description of said sand and of said resilient particles will be found in Canadian patent No 1,182,484.

Preferably, said pile elements are arranged in generally parallel rows. Advantageously, said parallel rows of pile elements are arranged in an irregular pattern, chosen from the group comprising: standard zig-zag, modified zig-zag, or step over.

DESCRIPTION OF THE INVENTION

0.625 2.25

0.625 × 2 = 1.250

2.25 × 2 = 4.50

length = 1.25 - 4.50

minimum longer than 3 inches

The present synthetic turf playing surface uses ordinary sand (and preferably resilient particulate) to form a resilient, non abrasive playing surface.

The present synthetic turf playing surface boasts the following features:

- low cost surfacing for sports and other applications;
- quickly installed surfaces;
- surfaces that can be properly maintained at a level of resiliency that is safe for the players;
- surfaces that have much less torsion-inducing features for footing of the players, because of lower density of grass-like pile elements per surface unit;
- low-abrasiveness surfaces for golf driving ranges on which the golf balls fall; and
- that overall this synthetic grass-like turf playing surface enhances the playing characteristics of synthetic fields while lowering the installation costs.

According to the invention, the synthetic turf is produced according to the general teachings described in Canadian patent No 1,182,484, which is incorporated to the present patent application by way of reference. However, a major difference is in the interspacing between each two successive pile elements 6, namely: a spacing gap ranging between 0,75 to 1.25 inch. Also, the grass-like pile elements or tufts, 6, are now arranged in rows, which may be regular in shape, or even irregular (for example, according to the standard zig-zag, or modified zig-zag, or step

over pattern). The irregular patterns are interesting in that the grass-like appearance looks fuller than it would be if the tuft row shape would be regular. The pile height would be from 3\8 inch to 3 inch in length.

The reasons for the unusually large distance between the rows of pile elements (or grass-like tufts), *for golf tee off areas*, are the following:

- this widely spaced artificial grass needs to be turned in the direction that the pile elements where tufted, in order to get the maximum feel for hitting a golf ball off;
- by turning the grass around when installing at the back of driving ranges (in long sections), the club head engages more easily the synthetic surface and in a more normal manner; since the club head hits a continuous row of grass-like tufts as the club proceeds along its striking path, it is uninterrupted by the staggering effect of missing rows when hit across the rows of grass-like pile elements;
- to allow a golf club head to more easily penetrate through the grass-like synthetic tufts, during the downswing, in order to more closely simulate the *brushing action-like feel* of natural grass such as when hitting down on a golf ball on real grass;
- in known prior art systems, the high density of the synthetic grasses does not allow the same penetration of the golf club head, because of the intermeshed tuft yarn multifilaments at the surface of the synthetic grass;
- by widening the distance between the rows of synthetic pile

elements, the void area has been increased (for the club to effectively penetrate the surface) by at least 50% and up to 80 % in relation to an average golf club and for previous synthetic grasses; this is more similar in density to natural grass fields; since we have removed a large fraction of the grass-like tufts, there is a proportional reduction in the resistance to the golf club head from the impact of a club head;

- by widening the distance between the rows of grass-like tufts, the voided area has been increased and this allows for a golf tee to be more easily embedded into the resilient topdressing, without having to bend the normally upstanding synthetic tufts into the particulate material topdressing; this prevents the topdressing compaction, which could eventually lead to difficulties in the embedding a golf tee into the topdressing with normal physical force.

The reasons for the unusually large distance between the rows of synthetic grass-like tufts for large surfaces, such as golf driving range landing zones, are the following:

- to greatly reduce the cost to cover such field to be competitive with laying sod;

- the ball pickers for golf practice in driving ranges, use a tool that help them work more efficiently, such tool having many plastic wheels that squeeze a ground-standing golf ball between them in order to pick them up; these wheels have the *unexpected* result of quickly matting down the grass-like tufts, thereby giving the entire surface a very green look even though there is a very wide

gap between the rows of fibres that visually expose the sand.

The large distance between the rows of synthetic tufts also allows for the use of regular (washed) - but not necessarily dried - sand, as is the case in existing sand-filled synthetic grass systems. Using damp or wet sand in standard (prior art) sand-filled applications is virtually impossible, to properly fill in the voids between the pile elements, since the sand does not flow. Indeed, wet sand clings to the grass-like tufts, and the result is a very uneven distribution of the tufts as well as uneven compaction for footing. Since there is substantially more room between the grass-like tufts, damp sand can *fall* in between these rows and add to the necessary weight to hold down the synthetic surface. The use of regular sand substantially reduces the cost factor of both the installation and the material cost of the sanding operation. Less surface brushing is necessary, since approximately half of the sand will be immediately placed in between the rows of fibre without any agitation or brushing, contrarily to what is required with conventional, prior art systems.

Moreover, the distance between the rows of grass-like tufts also allows for resurfacing (by changing the topdressing) a field or area at a later date, when the playing field has become worn out or overly compacted. Prior art systems of sand-filled grasses become matted down and the tufts tend to mesh together to form a virtually unpenetrable surface that is very hard to add or remove topdressing to in such applications. Using a power sweeper

to brush out the topdressing, the surface can be renewed to its new status, whereby the life of the product is extended. This is especially important for large field applications, where the topdressing always has a tendency to time-compact and to become harder than is necessary, which is to say, to become more dangerous to the players.

Raking the topdressing to the required depth for particular sports and sport shoes can be effectively done using a rake that has teeth interspaced to fit the interspacing pattern of synthetic pile elements (0,75 to 1.25 inch interspacing), where these rake teeth will easily penetrate between the rows of fibres to loosen up the topdressing if necessary.

The large spacing gap between each successive pair of synthetic grass rows also allows for the removal of contaminants on a large field, contaminants brought e.g. from flooding activity. On standard synthetic grass, the removal of such materials would be very difficult because of the density of the pile elements. This also applies to new golf course or other large applications, whereby sand from sandstorms, or dust and dirt, could cover an entire surface. This sand and\or dirt would normally contaminate the existing surface and could not be removed. This new grass could have the sand removed without any adverse effects.

The spacing of the synthetic tufts also allows us to install the playing surface without a secondary backing. This means that the playing surface is water-permeable. It also means quicker installations at lower costs.

Because of the interaction of the shoe spikes or cleats in various sports, the distance between the rows of fibres allows the pivoting in any direction without undue resistance from the density of the tufts of pile fabric. The larger distance between the rows of segments of multi-filament yarns (synthetic tufts) also allows for *in situ* sewing of the seams with a much larger margin of error, since there is already a large gap between the rows of tufts (from 3\4th of an inch to 1.25 inch). This sewing of the seams reduces the material cost, and saves valuable time to seam up, since no adhesive is used as well as no seaming plastic on which the adhesive is usually spread onto in order to lay the grass into to seam it up.

Sewing of the seams in this manner also allows for the immediate stretching of the carpet and the immediate installation filling of the topdressing, or sand, or resilient materials. There is no need to wait for the adhesive to *set up* before stretching the carpet to remove any wrinkles. If the carpet cannot be sewn or stretched prior to sand filling, it would be virtually impossible to adequately and economically remove any wrinkles in the carpet over a large surface for other sports where players run on this surface without wrinkles to trip on, if installing without a secondary backing.

Since sewing the seam and stretching same is possible, the added benefit is that the *selvedge* of the grass lays flat under the synthetic grass, producing a very level seam that can be immediately top-dressed without needing to trim excess material

off.

The present synthetic grass would be particularly useful to, without being limited to, playing fields for soccer and football matches. Soccer player shoes typically have ground-engaging, cylindrical spikes, with a flat discoid free end face. These shoe spikes having an average diameter ranging between 0,35 to 0,5 inch;, while two successive spikes are spaced by a distance ranging between 0,75 inch to 1,5 inch.

It is therefore understood that the average diameter of a soccer or football shoe spike or cleat ranges between approximately 0,35 inch to 0,5 inch, while the spacing gap between two such spikes or cleats from a given shoe would range between 0,75 to 1,5 inch. We will recall that the allegedly *useful* spacing gap between two successive grass-like pile elements mentioned in Canadian patent No 1,182,484 was said to range between 0,125 to 0,333 inch. Clearly, these numbers indicate that the diameter of a spike or cleat from a conventional soccer or golf shoe (0,35 to 0,5 inch), will be on average greater than the average spacing gap (0,125 to 0,333 inch) called for in Canadian patent 1,182,484 between two successive grass-like upstanding pile elements. This therefore means that, each time such a spike or cleat engages between two successive pile elements, these successive pile elements will be subjected to a transversely acting load, i.e. they will be temporarily forced apart from one another. As this spike or cleat engages - under the weight load of the walking player - into the particulate material top-dressing, and sinks toward the

woven fabric backi[redacted] - to which is sewn the u[redacted]anding pile elements (segments of multi-filament yarns), the bottom (root) portion of these filament yarns will in turn be subjected to a laterally-outwardly acting shearing force, which will in effect tend to produce a pile element unrooting force. Such an unrooting force will eventually produce the undesirable result of tending to release the upstanding filament yarns from the woven fabric backing. This unrooting force will be substantially magnified (it will further bias these upstanding filament yarns into a translational motion) if the ground-standing player engages into a pronounced, half-turn pivotal rotation around one foot, as when a soccer player engages into the so-called *back-flip kick* (in which the soccer player pivotally rotates on the ground half a turn on one upstanding leg, before tilting his whole body spacedly over ground around a horizontal axis, to bring the foot of his other leg over his body to strike at an incoming aerial soccer ball exactly at the time the ball reaches the player, which no doubt requires an exacting timing which could be hampered by any resistance from the ground surface pile elements).

Since in the present invention, the spacing gap range between two successive upstanding filament yarns is always greater than even the largest diameter of spike or cleat of soccer or golf shoes, then it follows that the filament yarns should not be subjected to an unrooting-biasing spreading apart force; therefore, the durability of the present synthetic turf should be increased.

It is the present inventor's position that an unexpected,

particularly advantageous outcome results from selecting an interspacing gap (which could be as large as 0,75 to 1.50 inch, but preferably ranging between 0,75 to 1,25 inch, and most preferably being limited to a range between 0,75 to 1,00 inch) between two successive rows of turf pile elements according to the present invention, being *greater* than the average diameter (0,125 to 0,333 inch) of a sporting shoe spike or cleat, while remaining *smaller* than the average distance (including the two successive spikes or cleats' diameters) spanned between two successive spikes or cleats (which could be as large as from 1 to 2.167 inch, but usually within 1.25 - 1.5 to 2.167 inch range) from a given sporting shoe. Indeed, it is highly desirable that a shoe spike or cleat diameter be smaller than the interspacing gap between any two successive turf pile elements (to prevent pile element unrooting), while at the same time providing that the distance spanned by two successive spikes or cleats on such a shoe be greater than said pile element interspacing gap (to ensure that each said interspacing gap form a single channel for providing free sliding displacement of a single spike or cleat through the particulate material topdressing).

It is understood that, when we refer hereinabove to a playing surface, such a playing surface is for field sports such as soccer, football, golf, and other such sports. When we refer to a spike bearing shoe, it is also meant to extend to a cleat-bearing shoe.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED, ARE DEFINED AS FOLLOWS:

1. A playing surface for field sports games, where the players wear spike-bearing shoes, said playing surface comprising:

(a) a firm, stable subsurface;

(b) a pile fabric, having a flexible backing and normally upstanding grass-like pile elements, the length of said pile elements being substantially uniform and lying in the range from 0,375 to 3 inches,

wherein said pile elements further define an interspacing gap σ between any two successive said pile elements, whereby:

$$0{,}75 \text{ inch} \leq \sigma < 1.50 \text{ inch}$$

and

(c) a top-dressing layer, comprising at least sand interspersed among said pile elements to a substantially uniform depth at least half the length of said pile elements.

2. A playing surface for field sports game as in claim 1, wherein said pile elements further define an interspacing gap σ between any two successive said pile elements, whereby:

$$0{,}75 \text{ inch} \leq \sigma < 1.25 \text{ inch} .$$

3. A playing surface for field sports game as in claim 2, wherein said pile elements further define an interspacing gap σ between any two successive said pile elements, whereby:

$$0{,}75 \text{ inch} \leq \sigma < 1{,}00 \text{ inch} .$$

4. A playing surface for field sports game as defined in claim 1, wherein said top-dressing layer comprises a mixture of from 24 to 95 volume percent resilient particles and from 5 to 75 volume percent fine sand interspersed among said pile elements.

5. A playing surface as defined in claim 1, wherein said pile elements are arranged in generally parallel rows.

6. A playing surface as defined in claim 3, wherein said pile elements are arranged in generally parallel rows.

7. A playing surface as defined in claim 6, wherein said parallel rows of pile elements are arranged in an irregular pattern, chosen from the group comprising: standard zig-zag, modified zig-zag, and step over.

8. A playing surface as defined in claim 1, wherein a tack coat is further applied to said subsurface, so as to bind said pile elements thereto, for improved pile elements binding capability for large synthetic turf field applications.

9. A playing surface as defined in claim 1, wherein said flexible backing defines a number of separate flexible backing sheet units, each said sheet unit defining a peripheral edge portion successive said sheet units being edgewisely sewn to each other along their said edge portions, whereby the thereby defined seams boast improved wear resistance and a uniform, seamless-like appearance.

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REMPLACEMENT

SECTION is not Present

Cette Section est Absente